AUTHOR'S EDITION.

FROM THE ANNUAL REPORT OF THE DEPARTMENT OF AGRICULTURE FOR THE YEAR 1888.

REPORT

OF

THE BOTANIST,

DR. GEO. VASEY,

FOR

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WITH ILLUSTRATIONS.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
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REPORT OF THE BOTANIST.

SIR: I have the honor to transmit herewith my report for the past year, together with some papers on economic plants, and a report on the "pastoral resources of Montana," prepared by Mr. F. W. Anderson, from personal observation. The investigation of the grasses of the arid districts has been continued, principally in Texas, a full report of which will be published in a bulletin. An experiment station for the trial, in cultivation, of such grasses and forage plants as give promise of usefulness in an arid climate, has been established at Garden City, in southwestern Kansas, and will be energetically prosecuted during the coming season.

Another grass station has been established in Mississippi, in connection with the State Agricultural Experiment Station near Starksville, to investigate and experiment with reference to grasses suitable for cultivation in the Southern States. If these stations are faithfully prosecuted through a sufficiently long period of time, I think the results will be highly beneficial to the grazing interests of the country.

Very respectfully,

GEO. VASEY,
Botanist.

Hon. NORMAN J. COLMAN,
Secretary.

GRASSES AND WEEDS.

1. *Reimaria oligostachya.*—This grass has not been found hitherto except in Florida and Cuba. It has been collected near Jacksonville by A. H. Curtiss, growing in ditches and on low grounds. It resembles some of the species of Paspalum, particularly *P. vaginatum*, and indeed can hardly be distinguished from the latter except by an examination of the flowers. The stems have a creeping habit at the base, sometimes running several feet, and rooting at the joints every inch or two. At the extremity the stems rise upward for a foot or two and develop the flowers. The leaves are 3 or 4 inches long, and very narrow, frequently becoming involute (folded or rolled together lengthwise) and sharp pointed. The sheaths of the leaves are loose, and generally as long as the joints of the stem.

The flowers are borne in spikes at and near the extremity of the culms, usually about three, sometimes two, and rarely four or five. These spikes are from 2 to 3 inches long, each with from ten to fifteen closely appressed spikelets. In structure the spikelets are like those of Paspalum except in having but two stamens instead of three, and in having the flower glume either entirely absent, or reduced in size to a fourth, a half, or three-fourths of the size of the other.

Generally the lower spikelets of each spike will have the lower glume absent, and the upper spikelets will have the lower glume in graded sizes to the uppermost, which may have two full empty glumes. The grass is nutritious and valuable for feed, but probably can not thrive except in the hot climate of the Gulf coast.

Plate I, Fig. 1, is a figure of this grass; *a*, a spikelet magnified showing the one empty glume, the flowering glumes, palet, two stamens, and two styles.

2. *Paspalum vaginatum.*—This grass is also a native of Florida and of the hotter parts of America, and is so similar to the preceding that the same general description will apply to it. It however seldom has more than two spikes in which the acute spikelets have the regular two empty glumes, and three stamens and two styles. It is not improbable that these plants may be found to be variations or forms of the same.

Plate 1, Fig. 2, shows *Paspalum vaginatum; b*, a spikelet magnified showing the empty glumes, flowering glume, palet, three stamens, and two styles; *c*, front view of the flower; *d*, flower opened to show the flowering glume and palet.

3. *Paspalum distichum.*—This grass is in habit very similar to the preceding, but usually grows on drier soil, with taller and more erect culms. The leaves are generally wider, the spikes are rarely more than two, the spikelets are smaller and more numerous with two empty glumes, and the flowers have three stamens. It has a wider range than *P. vaginatum*, being found in the Southern States from Virginia and Tennessee to Florida and Texas, thence to California, and as far north as Oregon. This species, as well as several others of the genus, has received some attention in the South as being useful pasture grasses. Their creeping habit gives them stability and capability to endure drought, and they form a close, tenacious sod, well adapted to close pasturage. At the same time, under favorable circumstances, this species produces a large yield. Mr. W. A. Saunders, of California, writes recently as follows:

> Are you aware of the value of *Paspalum distichum* for seeding pond-holes that dry up, or nearly so, in autumn? Such ponds are usually spots of bare, stinking mud, but when well set to this grass will yield all the way up to 80 tons (in the green state) of autumn feed for stock, especially valuable for cows first; then follow with sheep until every vestige is devoured. Surely it has an immense food value in such places.

Plate 2 shows *Paspalum distichum; a*, a spikelet enlarged; *b*, the same expanded, showing the two empty glumes and the flower.

4. *Setaria viridis* (Green Foxtail).—In almost all cultivated and waste grounds, particularly in wheat fields after cutting, there is found an abundant after crop of what is called pigeon grass or foxtail. There are two species of this foxtail, which, although found in the same field, may be easily distinguished. One is *Setaria glauca*, with an erect culm and cylindrical spike, and the bristles of which are usually of a yellowish color. The other is the *Setaria viridis*, which has a weaker stem, the spike rather looser, tapering at the apex, and with the bristles longer, and green in color. In this species also the spikelets are rather smaller, the lower glume shorter, and the grain less distinctly wrinkled. The seeds of both kinds are eagerly sought for by birds and poultry in grain fields after harvesting. The grass is probably introduced from Europe.

Plate 3 gives a view of the grass; *a*, a single spikelet enlarged, showing the parts and the bristle below.

5. *Oplismenus setarius.*—This grass is found in Florida and in other States near the Gulf of Florida, reaching to Texas, and thence into Mexico and other tropical countries. It grows in woods and shady places. The stems are at first prostrate, often branching and rooting at the joints. They send up a weak flowering culm, with a loose raceme 4 to 6 inches long, composed of five or six short, sessile, one-sided spikes, about half an inch long, each containing from six to twelve spikelets in two rows on the rhachis. The spikelets each contain one perfect flower, and one which is male or only rudimentary, and have three empty awned glumes, the lowest of which has the awn two or three times as long as the spikelet. The flowering glume is awnless, and like a Panicum.

Plate 4 shows this grass; *a*, a single spikelet enlarged, showing the awned lower glumes, and the two flowers, one male, the other perfect. Although this grass furnishes a considerable amount of good wild forage, it is not probably adapted to general cultivation.

6. *Beckmannia erucæformis* (Slough grass).—This genus is closely related to Panicum and has considerable resemblance to some forms of *Panicum crus-galli.* It grows abundantly in the Rocky Mountain region from California and Oregon eastward as far as Iowa and Minnesota. It is found in marshy ground and in sloughs, particularly in the neighborhood of streams.

It usually grows in tufts, and is of a coarse growth, the stout roughish culms rising to about 3 feet in height; the thickish leaves are about half an inch wide and 6 to 8 inches long. These as well as the loose, long sheaths are strongly marked with numerous parallel veins. The panicle is generally long and narrow, from 6 to 10 inches long, and half an inch to an inch wide, composed mostly of many very short, closely set branches, which are more or less interrupted below, where the branches are generally longer, sometimes 2 inches long and erect.

The spikelets are crowded very closely together on the one-sided spikes, and each one consists of a pair of thickish, compressed, inflated, boat-shaped, empty glumes, and between these, one lanceolate-acute flowering glume, of thinner texture, with its still thinner palet, and the stamens and styles. These are represented in Plate 5, *a* showing an enlarged spikelet, *b* the same expanded to show the separate parts. In some localities this grass is abundant and forms a valuable resource for stock. The bottom leaves and sterile shoots are tender and much relished. Mr. F. W. Anderson says:

> It makes good hay. When the plants are thick together the aftermath of slender, juicy leaves quickly grows, remaining green till quite late in the year. It is to be recommended for cultivation in low, wet meadows generally.

Others, however, regard the grass as coarse and without value.

7. *Anthenantia rufa.*—Culms erect, 2 to 3 feet high, from strong creeping rhizomas; leaves rather rigid, linear, 10 to 15 inches long, three lines wide, abruptly pointed, and with the sheaths of a purplish color; panicle 4 to 8 inches long, narrow and loose, the branches in clusters of 3 to 5 or more below, flowering nearly to the base; spikelets on short, slender pedicels, loosely racemose on the branches, each containing one perfect flower, and one neutral or imperfect one, the two outer glumes five-nerved, hairy, as long as or longer than the flowers; the perfect flower with a rigid glume and palet, the sterile flower with a thin, membranaceous palet. This species occurs in low and swampy pine woods in the Southern States from North Carolina to Mississippi. No efforts have been made in its cultivation.

Plate 6 represents this grass; *a*, a spikelet enlarged; *b*, the same expanded showing the separate parts.

8. *Amphicarpum Purshii.*—An annual or biennial, erect, rigid grass, growing 2 to 2½ feet high, in the sandy pine barrens of New Jersey, Delaware, and the Southern States. The leaves are mostly at the lower part of the culm, lanceolate, acute, rough (especially on the long sheaths), 4 to 6 inches long and three to four lines wide. The panicle is rather close, 4 to 6 inches long, the slender branches erect, sometimes single and sometimes in twos or threes, 1½ to 3 inches long, rather loosely flowered. The spikelets are sessile, or very short-stalked, and consist of a pair of lanceolate, acute, five-nerved empty glumes, and a single flower with rather rigid glume and palet, and with three stamens and two styles. These flowers, although apparently perfect, do not produce seed, but there is another kind of spikelet at the base of the culm which bears the seed. These are borne at the extremity of long, slender peduncles or secondary culms, one or two on each peduncle. They are twice as large as the spikelets of the panicle, and have thickened, many-nerved outer glumes, with the flowering glume and palet hardened. There are but two species of this genus known; the second one is found in pine-barren swamps in Florida. They furnish a certain amount of feed in the sandy pine lands of the Atlantic coast.

Plate 7 shows the plant with the two kinds of spikelets; *a*, perfect flower enlaged; *b*, the same expanded; *c*, the seed; *d*, a fertile flower enlarged and expanded showing the parts.

9. *Leersia Virginica* (Rice-grass).—This is a common grass in damp, open woods, and along the margins of streams.

It is weak-stemmed and much branched, growing about 3 feet in length, with an abundance of bright-green leaves, 4 to 6 inches long, 3 to 4 lines wide, and having rough margins. The main culm and the principal branches are terminated with a slender panicle of 4 to 6 branches, which are at first appressed to the main axis, but finally become spreading These branches are single and slender, from 1 to 2½ inches long, the lower part naked, the upper part closely flowered. The spikelets are very small and consist of two glumes, inclosing the stamens and styles. The outer glume is broad-oblong, thickish, and much compressed or flattened, and is rough on the back and margins with stiff, short hairs. The second glume is much narrower, and also rough on the nerves. There is no palet, but the stamens and styles are inclosed by the upper glume.

This grass furnishes a part of the native feed in open, wet woods, and is sometimes sufficiently abundant to be cut for hay.

Plate 8 is a figure of the grass; *a*, an enlarged spikelet showing the separate parts.

10. *Poa Andina.*—This is one of the many "bunch grasses" of the West, so named from its habit of growing in bunches. It is an inhabitant of all the interior mountainous country and of the high plains.

It grows from 1 to 1½ feet high, with an abundance of root-leaves, which are about half as long as the culms, very narrow and stiff, folded or rolled together lengthwise, and very sharp-pointed. The leaves of the culm are very short, erect and stiff; the lower one about 2 inches; the second, 1 inch long, and the upper one shorter; all of them have loose, striate sheaths. The panicle is usually lanceolate or oblong, 2 to 3 inches long, and about half an inch wide, close and densely flowered; the branches short (one-half to three-fourths of an inch), and mostly sessile and alternate, the lower one sometimes at a

short distance below the others. The spikelets are about three lines long, with five to seven crowded flowers. The empty glumes are thin, ovate-oblong, two lines long, the lower, one-nerved; the upper, broader and one-nerved or faintly three-nerved below; the flowering glumes are about two lines long, more or less rounded on the back, very thin and blunt at the apex, either nearly smooth or softly puberulent on the back, and ciliate on the margins.

Attempts should be made to introduce this species into cultivation in the arid districts.

Plate 9, a figure of the grass; *a*, an enlarged spikelet; *b*, a floret expanded and showing the separate parts.

11. *Agropyrum glaucum* (Colorado Blue-stem).—This species prevails on the western plains and in the mountains, and is well known to stockmen. It is generally known by the name of blue-stem, or blue-grass, and is sometimes called gumbo-grass.

It is closely related to the quack-grass or couch-grass of the Eastern States. It has a stiff, erect culm and leaves, which are usually of a bluish-green color. On hard, dry soil, its growth is low and sparse, but on low, moist ground it often grows 2 to 3 feet high, and is considered valuable for hay. On the borders of ditches and on irrigated ground it yields a heavy cutting. The flowering spike has somewhat the appearance of a starved, beardless head of wheat. It has great persistence in the ground on account of its strong, running rootstock. Whether it will, in cultivated ground, become as difficult to eradicate as its eastern namesake can not now be predicted, but where a persistent, nutritious grass is the great want of a country, as on the arid plains, it is worth taking some risks.

Fig. 11 represents the species; *a*, an enlarged spikelet consisting of the two empty glumes, and nine florets, two of which are expanded and show the separate parts.

12. *Plantago Patagonica* (Western Plantain).—The specific name which this plant bears would indicate that it was a native of Patagonia. It was probably first described from Patagonian specimens, but is extensively spread throughout South America, and into various parts of North America, particularly on the Pacific coast, and from Mexico into Texas, the Great Plains, and through the Mississippi Valley into British America. Within a few years past it has spread into many places in the Eastern and Southern States. It belongs to the plantain family (Plantaginaceæ), and presents a number of marked varieties.

It is a small, annual plant, seldom more than 10 or 12 inches high, and, like most of the family, has its leaves clustered near the ground and sends up one or more slender flowering stalks which are naked below, and above, present a close spike of flowers succeeded by seed. The leaves are very narrow, 3 to 5 inches long, with a few prominent ribs running nearly parallel from base to apex. The variety which is figured is generally clothed with soft, silky hairs. The flowers are small and present the characters common to the genus, which we need not here particularize. They are succeeded by the very numerous small capsules or seed vessels, which are oblong, with thin walls, and each containing two large seeds. These capsules have a remarkable way of opening to discharge their seeds. Near the middle of each capsule and passing round it horizontally is a line or mark, where, at maturity, the upper part separates like a lid, and exposes the contained seeds.

Mr. F. W. Anderson states that in Montana this plant is causing

trouble in hay-lands. It is self-seeding and very prolific. The seeds ripen and spring up the same season and mature the next year. Where nothing hinders the development of the plant, by its very numbers it drives out the grama and blue-joint grasses in large patches. In the spring, just before the flowers open, a patch of these plants looks like hail on the ground at a little distance, owing to the thousands of white, silky-villous spikes which rise in all directions. Stock do not like to eat the plant, and farmers are beginning to detest it.

Plate 11 represents this plant; *a*, an old spike gone to seed; the bracts are very conspicuous; *b*, a younger spike in flower; *c*, a very young spike; Fig. 1 shows a back view of the flower with the calyx removed; 1, *a*, the mark of circumscissile dehiscence; Fig. 2, a front view of the flower, the calyx present and a short bract at its base; Figs. 3 and 4, portions of empty capsules, front and oblique views, showing central placenta; Figs. 5 and 6, dorsal and ventral views of a seed.

Figs. 1 to 6 greatly enlarged.

13. *Lygodesmia juncea.*—This is a homely, scragged, perennial weed, prevailing throughout the Rocky Mountain region. It is a naked-looking composite plant, closely related to the chicory plant of Europe. It grows about a foot high, with a rigid stem and branches which are marked with fine ridges and furrows. The leaves are small and inconspicuous, the larger ones being linear-subulate and about an inch long, one at the base of each of the branches, the upper ones becoming gradually reduced to small bracts or scales. Each branch is terminated by a single head about half an inch long, containing five flowers surrounded by an involucre of slender scales, and a few much-reduced ones at the base. The flowers are all of the strap-shaped form, having a broad fringed summit, and of a rose color. At the base of the flower is the *akenium* or seed, surmounted with a copious tuft of long, white hairs, constituting what is called the *pappus*. The *akenes* are linear and five-ridged or ribbed.

Mr. Anderson states that the plant is native and common in Montana, and has a deep, perennial root which it is hard to destroy. It is especially pernicious in vegetable gardens, where it easily chokes out young plants and causes much trouble. It will thrive in hot, dry weather, when most other plants are weakened by the heat and drought. Hoeing up the plants while the flowers are in bud is recommended. The plant blooms and scatters seed from the end of June till October, so that an enormous number of seeds are matured each season. In cultivated ground the plant becomes much distorted.

Plate 12 represents the plant; Fig. *a* is a branching stem torn off near the base; Fig. *b*, a single floret; *c*, a seed with its pappus; *d*, an empty involucre showing five punctures on the receptacle where the florets were attached; *e*, a portion of a thicker stem, showing one of the larger leaves.

14. *Solanum triflorum* (Wild Potato).—A low, herbaceous, much-branched and spreading plant of the same family as the common potato, growing on the plains from New Mexico northward into British America. The stem and branches are weak and decumbent, seldom over a foot long, but very numerous from one root. The leaves are alternate, 1 to 2 inches long, oblong in outline, deeply cut into lobes, from three to five on each side, and tapering below into a narrow margin. From the axils of the leaves there proceed slender *peduncles* or flower-stems, about an inch long, each bearing about three small, white or pale-blue flowers, which resemble those of the

common potato but smaller. Each of these flowers is succeeded by a small, greenish berry, containing numerous small seeds.

Mr. Anderson says of this plant, that five years ago it was comparatively rare in northern Montana. It could then be found here and there on the prairies or near water-courses, but during the past three years it has notably increased, owing to the increased cultivation of the soil.

The plant grows better in cultivated ground, and it is a fact worth recording that it grows best of all in situations particularly suited to the development of the common potato (*Solanum tuberosum*). In its final condition the plant spreads on the ground in mats 3 feet or more across, the branches usually rooting all along the parts touching the earth, and bearing many pale blue to purplish flowers. I had noted several years ago that potato-bugs live upon the leaves. In 1887 and 1888 an enormous crop of potato-beetle larvæ were produced, chiefly upon this weed. It is a regular swarming place for Colorado beetles, which lay eggs by the thousands on the leaves everywhere.

Plate 13 is a figure of this plant; *a*, *b*, a flower and bud enlarged; *c*, a cluster of mature berries, with a tuft of leaves; *d*, a berry cut transversely; *e*, a berry cut vertically.

The grasses of Plates 1 to 11 are one-half the natural size.

THE PASTORAL RESOURCES OF MONTANA.

By F. W. Anderson, *Special Agent.*

Not many years ago this Territory was regarded as a part of the vast waste called the Great American Desert. Even her wealth of mineral resources was not realized, and the country was considered fit only for the hunter, the trader, and the Indian agent. But at last, when the rich mineral discoveries of Alder Gulch and Virginia City created such a stir, miners, adventurers, and fortune-seekers flocked to the Territory from all directions. It was then that people began to see in the mineral productiveness of the soil a promise of future greatness for Montana. Mine after mine was discovered, keeping alive for years the feverish excitement incident to gold hunting on the "bars," for nearly all mining in those days was *placer*. Long years before the shriek of the locomotive echoed with shriller notes in Montana's mountains the hoarse cry of the "bull-whacker" and the sharp crack of his quirt affrighted the timid game feeding peacefully on the mountain slopes. In those days the value of a good mule or ox train was estimated at about $6,000 in gold, and many a fortune has been made, and often lost again, carrying provisions and implements of toil to the hardy pioneers of the Territory. Soon it was discovered that mules and oxen grew fat on the native grasses, thus suggesting possibilities in another direction, viz, that of stock-raising. At first it was feared the extreme cold of winter could not be withstood by cattle or horses on the open ranges. It was considered out of the question to feed hay, for that was worth $60 a ton, sometimes more. However, wintering cattle on the open ranges was tried, but with discouraging results. A few of the originally imported stock still survived, and, in a measure, had become acclimated. These passed through a milder winter than usual, and spring found them in fair condition. They bore fine, healthy calves, and thus fresh hope was infused into the minds of experimenters.

From that time on the stock business has steadily increased until

now it has reached magnificent proportions; and as one travels over the Territory north, south, east, or west, he is pointed out with pride, by the inhabitants, the costly residences and large herds of cattle owned by the "cattle kings," as the successful men have been dubbed.

Where Captains Lewis and Clarke, the explorers, over eighty years ago saw thousands of buffaloes, elks, and deer feeding on the open plains bordering the Missouri River, near the falls now roam thousands of horses and cattle which obtain sustenance the year round by eating the native grasses. Upon the same plains a hundred years ago the Indians' horses also grazed.

MINING AND STOCK-RAISING.

The two leading industries are mining and stock-raising. Quartz mining is now the chief branch of the former; but in early times placer mining, because of the remoteness of the country and difficulty of access, was the only branch sought and pursued. The manner of raising stock is very simple. Horses and cattle are permitted to roam over their owners' ranges at will, and are "rounded up" only for the purposes of branding, castrating, counting, and selling, all of which work is usually performed at stated times of the year. But sheep, although kept in large flocks or "bands," are cared for by a shepherd or "herder," partly because they scatter far and wide in small groups if left to themselves, and partly because they need protection from wolves and coyotes. The average-sized band of sheep will probably contain 2,500 head, but many flocks number over 5,000 head; but these are too many for one man to properly care for, and the weak, the old, and the lame animals have a hard time of it.

While horses, cattle, and sheep all bring forth their young on the open plains, sheep are the only stock receiving any attention at this period. Extra men are employed during the "lambing season," and the flock is generally divided up into three—those to lamb, those lambing (or within a day or two of it), and those that have lambed; this is done for obvious reasons.

Cattle are raised for beef, no practical attention yet being paid to dairying; horses are raised for speed and endurance, very few draft animals being bred; while sheep are hardly ever raised for any purpose but wool-growing. But the time is close at hand when every industry connected with these animals will receive its merited attention.

GENERAL FEATURES OF MONTANA.

The southern and western parts.—Looking at a map of the Territory one sees that the southern and western parts are much broken by small, isolated groups of mountains and hills. If one traveling over these parts will take time to climb a few of these mountains he will see at once, that this is the exact nature of the country. Far below him he will see valleys and plains of greater or less extent surrounding each little range. Looking towards any point of the compass he will see the same plains wandering between and around other isolated mountain groups in the distance, strongly reminding him of a great quiet lake, dotted with huge, rocky, often pine-clad islands. These groups are all called ranges by the local inhabitants, but many of them seem too small to deserve such a name.

Looking at the map again one will observe the course of the main divide of the Rocky Mountains. Well defined and broad, it retains

its individuality from near the northeast corner of Missoula County, through the eastern and central length of Deer Lodge County, and half through Silver Bow County on its eastern border. Here it becomes broken and fragmentary. The Bitter Root Mountains extend along the southwestern border and continue all along the western line as far north as the forty-eighth parallel in Missoula County. Much of the country between the Bitter Root Mountains and the main range is very rugged. So far as I have seen the prevailing rocks in these regions are gray granite, porphyry, slate, and limestone, but occasional large areas show outcroppings of a reddish-colored lava. Especially was this last feature observed in the vicinity of the McCartney Range in the northeastern corner of Madison County.

The majority of the little mountain clusters contain in their bowels gold, silver, copper, and lead. Ironstone of several varieties is also abundant, so that iron and lime for fluxing the other metals are mostly near at hand, while the charcoal is made in the pine woods on the neighboring heights. In a few of the ranges free gold is found; very few of the diggings are rich, however, seldom paying more than ordinary days' wages ($3.50 to $6), while some few yield almost fabulous amounts per annum.

The plains already mentioned are mostly high, often stony, and, so far as I have seen or heard, always dry. The numerous valleys, through nearly all of which flows a stream of sparkling water, are for the most part narrow, but very productive. The chief crops appear to be oats, wheat, timothy, and native "bluejoint," potatoes, cabbages, turnips, and onions; corn is not grown as a regular crop. Fruit trees of any kind are rarely seen, and even then have only been planted by persons of unusually enterprising and progressive spirit. Even the small fruits, like gooseberries, currants, raspberries, and strawberries, are not cultivated, although ample evidence is given to show that they and other small fruits would do well; for many persons have volunteered the information that they go into the mountains once a year to pick a year's supply of these fruits for use in their families.

In these valleys and up many of the mountain gulches grow several species of poplar and willow. The balsam poplar is the commonest of the genus. *Salix flavescens*, var. *scouleriana*, *S. rostrata*, and *S. longifolia* are the common willows. Occurring with these are also the black or "mountain" birch (*Betula occidentalis*), which sometimes attains a size rarely seen in the northern part of the Territory, and a species of alder (*Alnus viridis*), often growing to a height of 30 feet. Occasionally such evergreens as *Juniperus communis* and *J. Virginiana* may be found also. On the mountain slopes several species of pine and fir occur. But the mountain tops are bare, or at most support a scattered growth of dwarfed pine (*Pinus albicaulis*, Eng.).

The high plains or benches for the most part produce a very thin growth of grass. In many localities are immense tracts, miles in extent, covered by sage-brush (*Artemisia tridentata*) growing to an average height of 4 feet; specimens are occasionally seen 6 feet high. The woody stems of this strange under-shrub are used as fuel in some parts. Another sage-brush (*A. cana*) is also common. It never is so tall or robust as *A. tridentata*. Greasewood (*Sarcobatus vermiculatus*), with its cruel spines, is abundant in many localities. It grows into a good-sized bush 4 or 5 feet high and very branching. The numerous short, rigid branchlets are usually tipped with a sharp point, giving them a spiny appearance. One may be severely

pricked in forcing his way through a patch of this shrub. I am informed, however, that this plant, despite its formidable appearance, is eagerly sought by range cattle, which live upon it when the snows are deep. I have seen cattle munch the branches, spines and all, as composedly as a donkey eats a thistle. The local inhabitants in the spring, when the young shoots are green and tender, boil them as "greens," and sometimes make pickles of them, too. I have not tasted cooked twigs, but have eaten the raw, succulent, linear leaves. The flavor is almost identical with that of the well-known samphire of our coasts. One more under-shrub contributes largely to the characteristic appearance of the southern and southwestern parts of the Territory, viz, *Bigelovia graveolens*, var. *albicaulis*. Like the sage-brush and greasewood it chiefly inhabits the high benches and dry bottoms. This variety seems to occur throughout the Territory; but nowhere, so far as I have observed, is it so common as in the counties of Silver Bow, Beaver Head, and Madison. Here we find it averaging 3 feet high, making the plains yellow for miles in late summer with its profusion of flowers, and in autumn imparting a peculiar grayish-green tint to the landscape. No animal seems to eat this plant, and, aside from the facts that it helps to cover the nakedness of the earth and draws a little moisture, it is to be regarded as a troublesome weed.

Agriculture, then, in the regions described is confined almost wholly to the narrow valleys and bottoms, along streams; it is not a chief industry, and never can be, owing to the very nature of the country. Mining takes the lead, stock-raising comes next. Here is a grand country for the latter purpose. Despite its dry plains and abominably numerous steep mountains and hills, it is abundantly watered. Scarcely one of its thousands of valleys is without a brook or a river of the purest water, easy of access. In many localities the grass forms a close turf. In this respect the southern parts of Madison and Beaver Head Counties can not be excelled. In making a random guess I would say that fully three-fourths of this entire region would always be open to the interests of stock-growers of all kinds. It is a splendid country for the purpose.

Northern and eastern Montana.—We now come to a wholly different country: the general appearance, the vegetation, and even the climate, all different. Here we have the three grand resources, mining, stock-raising and farming, on a more nearly equal basis, but instead of mining, stock-raising takes the lead. And here wool-growing is an important item.

Looking at a map of these parts we see a country abundantly watered and possessing only a few (comparatively) mountain ranges. The many creeks or brooks and larger streams all find their way to one of three great rivers. The central river, the mighty Missouri, then receives the two others—the Milk River from the north and the Yellowstone River from the south. Ascending to the summit of any convenient mountain in northern Montana, and looking as far as the eye can reach with the aid of a field glass or telescope, one sees a grand series of beautiful rolling plains, thickly covered with grass. Here and there the winding valleys mark the courses of the streams. In the distance are mountains, purple, and blue, and gray. To the south and west one sees, though so far, the main range of the Rockies, its snow-clad peaks in bold relief. That range can be distinguished at a glance from all others.

Here we have a country pre-eminently fitted for pastoral and agri-

cultural pursuits. The extent of range for stock would be simply inexhaustible were not the soil so rich that agriculture is rapidly taking possession. In fact it is my opinion that in a very few years agriculture will have such a pre-eminence that herd laws will be enacted, at least for the protection of farmers in this region. Agriculture is making gigantic strides. It has been satisfactorily proven that the justly celebrated wheat lands of Minnesota and Dakota can not surpass the bench lands of northern and eastern Montana. Hundreds of progressive farmers and others are planting timber and fruit trees, everywhere meeting with success. So it is easy to foresee that in a few years the country will be so settled by farmers and growers of fine-blooded stock, who will keep their animals in pastures or other inclosures, that range stock will be crowded to the foot-hills and mountains, or else their owners will have to take them to those regions where there will never be a struggle between the tiller of the soil and the flock-master for possession of the field.

If one will go over any portion of the region now under consideration, after having gone over those parts described in the previous section, he will at once notice the difference in the vegetation. Nowhere here, except in the "bad lands" along certain portions of the Missouri River and in a few other parts, will be seen the sage-brush, Bigelovia, and greasewood, in any abundance. In going over the ground during summer the difference will be still more marked by the presence of a great variety of leguminous plants, many of them very beautiful in flower and foliage, which are dotted over these northern plains in all directions. In my own herbarium are twenty-three species and several varieties, representing the genus *Astragalus* alone, all collected in this region.

Along the small streams and rivers the common trees are *Populus monilifera*, *P. angustifolia*, *P. tremuloides*, and more sparingly *P. angulata*. Only one willow ever seems to become truly tree-like in size, viz, *Salix amygdaloides*. This species usually becomes of sufficient size for good, solid fence-posts, and at times even larger. It is considerably used for that purpose. Professor Coulter in his Manual of Rocky Mountain Botany, page 335, quotes that a form of *Salix cordata* sometimes affords durable timber, adding that "it is altogether incredible that any form of *S. cordata* ever attains tree-like size." So far as personal observations enable me to judge I think Professor Coulter is quite right. The very largest specimen of *S. cordata* I ever saw was not more than 5 inches in diameter at the bottom. It was the var. *vestita*, the common diamond willow, the same form that Professor Coulter comments upon. But *Salix amygdaloides* frequently becomes 18 inches in diameter. Where abundant it is much cut for cord-wood, making excellent fuel. Towards the mountains the poplars all disappear save *P. tremuloides*. The willows also are different, *S. rostrata* and a form of *S. glauca* being most common.

CLIMATE.

The climate of this Territory is a remarkable one. The winter weather of any new country is always the subject of special inquiry, particularly when stock-raising is in question. The following notes upon this and the other seasons may be of interest:

Winter.—Winter generally sets in in good earnest in the early part of January, seldom much snow or cold before then, and lasts until the middle of March or beginning of April. It is not a period of steady winter weather, however; a "cold snap" seldom lasts over

two or three days. According to statistics the average snow-fall in the course of a winter is about 18 inches. This does not fall all at once; neither does it fall from time to time, and accumulate for the genial warmth of the spring to dissipate. Here, in mid-winter, the mild breezes blowing inshore from the Japan Current sweep down over the mountains, often melting a foot of snow in a single day or night, and seldom letting one snow-fall lie upon the ground over two or three weeks. In this way the ground is frequently left bare for several weeks before the advent of another storm. At such times men go about in their shirt-sleeves, insects skip and fly about the prairies, and stock upon the ranges gain flesh. Some winters, however, the snow becomes crusted hard for weeks at a time; then range cattle suffer terribly, and many of them die because they can not get at the grass. Horses and sheep paw holes in the snow, "rustling for feed," hence seldom suffer. Cattle never paw; if they can not push the snow off the grass with their noses they starve or eat willows, which is nearly as ruinous. But the loss of cattle from this cause is not necessary, as it would take but little hay to keep them alive till a "chinook" came to break the icy bonds.

Spring.—Spring follows close upon winter; there is no gradual transition. Before the last chinook has swept away the snow-drifts, wild flowers of brilliant colors appear. Spring frosts rarely occur, except very close to and in the mountains. Farmers put in their seeds as soon as the ground is thawed enough for plowing, and seldom give them further attention till harvest time. In northern Montana an ample supply of rain falls during May and June. Spring here is nearly as warm as summer; for this reason, combined with the abundance of rain, vegetation grows with surprising rapidity. The "blue-joints" and other tall grasses are usually 3 feet high by the middle of June.

Summer.—This season may be said to develop from spring about the middle of June. Its hottest period is in August. Sometimes, but not often, the temperature is over 110° F. in the shade. The probable average is about 80° F. It is well known that sea-breezes are warmer in winter than the land atmosphere, and that they are cooler in summer; and so it happens that the same breezes which melt the snow and moderate the severity of winter here, gently blow, cool and refreshing, over the mountains and plains in summer time. Consequently, the heat of summer has not that oppressiveness so characteristic of it in "the States." It is seldom that one can not fully enjoy the comfort of a woolen blanket during a summer night.

Autumn.—Montana's autumn weather is perfect. The nights are cool, often frosty; the days are bright and mild. Whenever we have a good fall, stock are in prime condition for market, or to face the cold weather coming. This fine weather generally lasts till well on into November. (This year it is yet fine, and I sit writing this, the 22d of December, with my door wide open.) Then a small snow-storm occurs occasionally to remind one that winter has almost come again.

We have now glanced over the general features of the Territory, and in so doing have seen that the greater part of it, at least four-fifths, can be utilized for stock-raising. We have also seen that nearly half of it will eventually be devoted to agricultural interests. The south and most of the western part will always be a pastoral country, while the north and east will soon be almost entirely devoted to farming, horticulture, and the raising of fine, blooded stock, for which purpose very extensive areas are not needed by individuals. We have seen that, on the whole, the climate is a good one. This

good climate is probably mainly the result of two features, the close proximity and protection afforded by the main range of the Rocky Mountains, with its numerous spurs, and also of the cooling influence of the chinook wind blowing from the Japan Current in summer, and its warming influence in winter.

NATIVE GRASSES.

In agricultural circles there has been much talk about the "bunch grasses," "blue-joint grasses," and "buffalo grasses" of the Northwest. I shall not here pretend to present as large a list as Professor Scribner's "Agricultural Grasses of Central Montana," not having the necessary material to draw from; but the following list gives our most important species, as I have found them, in different parts of the Territory:

Beckmannia erucæformis, Host (Beckmann's Grass, "Slough-Grass").—Found throughout in low grounds, marshy places, and sloughs; to some extent also along the banks of mountain streams. In some localities it forms a valuable food for stock. Average height about 3 feet. The stout culms give off several bright-green leaves, 4 to 8 or 9 inches long. Several culms usually grow from one tuft. At the bottom of the plant are tender leaves and sterile shoots much relished by stock. It makes good hay. Where the plants are thick together, the aftermath of tender, juicy leaves quickly grows, remaining green till quite late in the year. To be recommended for cultivation in low, wet meadows generally.

Panicum capillare, L. (Panic-Grass, "Fool-hay").—Throughout; forming large "meadows" in some localities. Mostly found in waste or gravelly soil. Sometimes called "Fool-hay," because it takes so much to make a ton.

Panicum crus-galli, L. (Barnyard-Grass).—Professor Coulter in his Manual, page 404, says: "Very widely introduced, possibly indigenous somewhere on the continent." Undoubtedly indigenous here; occurring along streams and in gravelly places throughout. In the mountains usually dwarfed. Sparingly introduced into cultivated ground. Stock eat this grass readily. Leafy, many-stemmed, hardy, "self-seeding" unfailingly, it has much to recommend it.

Setaria viridis, Beauv. (Green Foxtail, Bottle-Grass, "Wild Millet").—Introduced into cultivated soil. Not common. Many farmers look upon it with great favor.

Spartina cynosuroides, Willd. (Cord-Grass, Marsh-Grass).—Throughout, in marshy ground along streams, and in depressions of valleys. So abundant in some localities that eventually it may cause serious trouble. In some of the meadows near Helena it constitutes nearly half the grass. It spreads by strong, scaly root-stocks, each of which is tipped by a stiff, sharp point, formed by the overlapping, terminal scales. Culms average 4 feet high, stiff and reed-like. Stock will not eat this grass, and it is useless for hay.

Phalaris arundinacea, L. (Reed Canary-Grass).—This valuable grass is common throughout. Abundant along many of the mountain streams and in moist valleys everywhere, especially in the southern part. Prefers moist situations, attaining a height upwards of 5 feet. Makes excellent hay. Cattle are very fond of the leaves and panicles. The latter, when full of seeds, they nip off and eat with evident relish. This species would pay well in cultivation, owing to the abundance of hay it would yield. (*Phalaris Canariensis*, L., is sparingly introduced.)

Hierochloa borealis, R. and S. (Vanilla-Grass, Seneca-Grass).—Is said to be common in some parts. I never saw it myself except along the banks of Belt River, in Meagher County.

Alopecurus pratensis, var. *alpestris* (Mountain Timothy).—This species has an unexcelled reputation as a grass for the pasture and hay-mow. Growing extensively in the mountains it often covers large open tracts known as "mountain meadows" and "parks." It is regularly cut for hay, and the delicious odor exhaled during the curing process is indeed "the scent of new-mown hay." There is no necessity for introducing foreign grasses into any region possessing a native species like this.

Aristida purpurea, Nutt. (Triple-awned Grass, Bunch-Grass).—Common, especially south and southwest. In the northern part the variety *longiseta*, Vasey, appears to be the prevailing form. Chiefly on gravelly, stony ground along bluffs and rocky hills in the northern part, but southward it is very abundant in some localities on the dry plains so characteristic of that region. Its habit of growing in stiff clumps, narrowed below, diverging above, has gained for it the usual name, "bunch grass." Cattle and horses eat the green clumps freely, but sheep prefer other grasses. A valuable adjunct to winter ranges; sheep, even, are often glad enough to eat it in winter.

Stipa comata, Trin. and Rupr. (Feather-Grass, "Bunch-Grass," "Needle-Grass," "Needle-and-Thread").—This common grass is known here by all the popular names except the first. Found throughout. It has the "bunch-grass" habit, the culms seldom exceeding 3 feet, usually but half that height. Stock are fond of the numerous, narrow, involute leaves crowning the base of the bunch. Commonest in poor soil and where "bed-rock" is near the surface.

Stipa viridula, Trin. (Feather-Grass, Bunch-Grass, "Wild Oats").—With the last, but apparently more abundant in richer, damper soil, attains a height of 4 feet, and in moist situations a still greater. Where thick enough it is cut for hay, of which it makes a fair quality. Stock like the seeds, which are numerous and taste like oats. I have frequently seen both sheep and cattle fight with their own kind over a well-seeded panicle of this grass.

Stipa spartea, Trin. (Feather-Grass).—Known here by the less delicate but certainly more appropriate name of "Devil's Darning-needle." This wretched grass is not common anywhere that I have been in Montana except in the foot-hills and valleys bordering the north aspect of the Great Belt Mountains near to the West Fork of Hound Creek and "the old Fort Logan road." It is to be hoped that it will not spread for years to come. In traveling afoot where this grass grows when it is in seed one is kept busy picking the surprisingly sharp-pointed seeds with their strongly-twisted awns out of trousers and sleeves. If allowed to remain these seeds rapidly insinuate themselves into the flesh. I have seen horses and cattle with the awns sticking out of their skin while the seed was completely buried beneath. The poor creatures suffer severely at times from the irritation thus set up. This grass has been reported from one or two other localities, but is said not to be common.

Oryzopsis cuspidata, Benth. (Mountain Rice, "Bunch-Grass").—This valuable grass is common throughout. Usually in clumps varying from 1 to 3 feet high. In the southwestern part it does not average over 8 inches high and one or two culms to a plant. The leaves are long and very narrow, growing from the middle and lower parts of the stem, usually few or none arising from the base. Panicle often

included below, but very open and branching above. From the tips of the slender branchlets grow the hard, nut-like flowers and seeds. The seeds are very nutritious, as good as oats, and are greatly relished by stock, especially cattle. This grass grows up early in the season and may be still found in a comparatively green state late in the fall, long after the seeds have ripened and fallen off. It would doubtless do well in cultivation, and seems to flourish best in sandy soil, where its long, fibrous roots always draw up the moisture. The fact of its being so nutritious and at the same time capable of thriving in what is usually considered the poorest of soil makes it well worthy the attention of all western Experiment Station authorities, as well as of northwestern farmers.

Oryzopsis micrantha, Thurber (Slender Mountain Rice).—Common but not abundant in many localities. Being less conspicuous than the last it has been generally overlooked. It is supposed to grow in Montana mainly at the highest elevations. Often nearly as tall as the last, but always very slender; the few and narrow branches of the panicle arranged in pairs. Many culms, fifteen or more usually arise from one tuft. Very leafy below; leaves narrow and setaceous-tipped, 4 inches to over a foot long; bright green, well flavored. Stock enjoy this grass. It could be profitably cultivated towards the mountains on rich slopes, or in moist valleys. It seems to have no special choice of habitat, however. I have seen it from 2 inches to over 18 inches high at the rocky summit of Mount Helena, and it grows over 2 feet high in one corner of my ranch in Sand Coulee. (Sand Coulee is a large valley of the plains near the falls of the Missouri River; altitude about 3,400 feet.) This grass is also common in the Bird-tail Mountains, portions of the Belt Mountains, and in the ranges south and west towards the Idaho line.

Muhlenbergia glomerata (Drop-seed Grass, Muhlenberg's Grass).—There seems to be no local name for this or the other Muhlenbergias found here. Ask a stockman what it is, his answer will be, "Oh, it's a kind of Foxtail, I guess." This species has been observed in the counties of Chouteau, Cascade, Deer Lodge, Silver Bow, and Beaver Head. But the only locality in which I have seen it abundant is at Warm Springs, in the extreme southeast corner of Deer Lodge County. It grows freely in the warm marshy ground about the springs. It extends by slender, brittle root-stocks, and in this county (Cascade) is much affected by *Ustilago Montanensis*, Ellis & Holway, which aborts the panicles of at least half the culms. Cattle eat the grass readily, and it seems to be a desirable one for cultivation, as it would yield a heavy crop of very good hay. It is a late-flowering species, producing great quantities of nutritious seeds. It seems to flourish just as well in ordinarily dry situations as in wet ones.

Phleum alpinum, L. (Native Timothy, Cat's-tail Grass, also called "Mountain Timothy").—Plentiful in all the mountain regions, along streams, openings in pine forests, and in the moister "parks." A valuable grass and much esteemed for hay. Seldom over 20 inches high, but sometimes upwards of 2 feet; culms often quite leafy.

Phleum pratense, L. (Timothy, "Tame" Timothy).—Can hardly be classed with the native pastoral resources, but has been introduced to a considerable extent. In the southern and western parts ample irrigation is found necessary to its successful culture. In the northern and eastern parts irrigation is not thought of. This year I saw 3 acres of splendid timothy 4 feet high, standing thickly on the top of the highest hill near Great Falls. The field, only "sod-breaking,"

is the property of Mr. John Glass. Timothy has become naturalized in the mountains about Helena. Isolated patches of it are frequently found in the Belt Mountains. Rev. F. D. Kelsey, the well-known "Helena botanist," reports it as having run wild in the mountains about Rimini. It grows sparingly along Black-Tail Deer Creek, near Dillon, and along the Red Rock River, near Spring Hill (Allerdice P. O). This plant is found in such unusually out-of-the-way places and is so widely distributed that some have suggested the possibility of its being just as much native to this region as *P. alpinum*.

Sporobolus cryptandrus, Gr. (Drop-seed Grass).—Along sandy banks of streams; also in cultivated soil. Very prolific, soon taking possession where allowed. Cattle and sheep eat it down close whenever they can get at it. Several other species occur, but appear to be of little or no value. *S. depauperatus*, Torr., is found throughout; very abundant in some localities, especially in Beaver Head County, where it is abundant on the bottoms mixed with grama and other grasses.

Deschampia cæspitosa, Beauv. (Hair-Grass).—This beautiful and variable grass is found throughout, but constitutes a regular forage plant in very few localities. It produces many leaves and culms from the tufted base, which are eagerly eaten by horses, cattle and sheep in the spring and early summer. It grows in a great variety of soils and can bear considerable drought. In a few isolated localities are stretches of valley several miles in extent, fine meadow lands, where this species, and grama grass, and *Poa tenuifolia* grow in about equal proportion.

Danthonia unispicata, Munro (Wild Oat-Grass).—Several species occur, but this is the only one I have found in abundance. It grows on the higher "bald" mountain slopes, often being the principal grass. Growing, in general appearance, it reminds one of a rich growth of grama grass; but the single terminal, erect spikelet is a peculiarly plain distinguishing feature. I believe this grass to be of almost as much importance on some of the higher mountains in proportion to the area of its habitat as the grama grass on the plains. I have had horses "picketed" days together in mountain "parks" where this was almost the only grass. They liked it and did well. In the herbarium of Mr. Robert S. Williams, of Great Falls, are specimens of *D. Californica* and *D. intermedia*, which he says are common in the main range at the head of the North Fork of Sun River.

Agrostis scabra, Willd. (Thin-Grass, Bent-Grass, also called "Foolhay").—Everywhere. In comparatively moist spots it sometimes covers many acres.

Agrostis exarata, Trin. (Bent-Grass).—I have never heard a local name for this common and valuable grass. It is variable in size and appearance, but under proper conditions grows over 2 feet high. Culms numerous, leafy, especially at the base; leaves flat, erect, the lower ones 2 to 5 inches long. It grows about springs and along streams, and ought to be cultivated.

Agrostis alba, L. (Bent-Grass, Red-top).—Abundant throughout in well-watered localities; often growing 3 feet high. An excellent grass for meadow or pasture.

The eastern form, *A. vulgaris* (Red-top), has been introduced sparingly into cultivation. It is also found here and there along the various lines of railroad, quite distinct in appearance from the native plant. It does best in low grounds, and like the native species bears considerable moisture. The latter is frequently found almost

choking some of the small shallow brooks or creeks. All kinds of stock thrive upon these grasses.

Ammophila longifolia, Benth. (Sand-Grass).—Throughout, but apparently most common in the northern and eastern parts; chiefly on dry hillsides and in sandy soil on the benches and bottoms. A very useful species, serving to bind loose soil and prepare the way for more nutritious forms; one to 5 feet high, rather stout. Although it has strong, creeping root-stocks it is easily exterminated when desirable; simple plowing and harrowing a few times checks its growth. For this reason it can be safely recommended as a truly valuable pioneer grass for reclaiming unproductive, sandy wastes. It is sometimes cut for hay, but stock will not eat it till compelled, unless it is cut young. It often grows in small circular patches, at other times irregularly covering large areas. It turns yellowish-brown in August or September, and may be distinguished from other vegetation at long distances.

Deyeuxia Canadensis, Beauv. (Reed Bent-Grass).—Common with *Phalaris arundinacea;* growing to nearly the same height; leaves long and numerous. It is worth cultivating, as are the following members of the genus:

Deyeuxia Suksdorfii, Scribner.—At a first glance one might take this for an *Agrostis*. Professor Scribner, in his interesting paper, "Agricultural Grasses of Central Montana," mentions it as being rather plentiful along Smith's River Cañon "on dry but rich limestone soil." Rev. F. D. Kelsey, of Helena, found it growing in sandy soil at the "Warm Springs" near Helena. (This is not the Warm Springs in Deer Lodge County, where the Territorial Insane Asylum is located.) This grass has every appearance of being the kind to cultivate. The slender, leafy culms are upwards of 2 feet high, bearing a densely-flowered panicle of a light straw color which is sometimes faintly and delicately tinged with rose-purple. The leaves are 2 to 8 inches long, and in my specimens 2 to 5 lines wide, and straight, growing numerously from the base. The plant grows in clumps or bunches.

Deyeuxia neglecta, Kth. (Reed Bent-Grass).—Common throughout in wet places with *D. Canadensis* and *Phalaris arundinacea*. It is of about the same height as the latter, but the leaves are mostly narrow and involute.

Bouteloua oligostachya, Torr. (Mesquite, Grama-Grass, "Buffalo-Grass").—Is not called mesquite here. I have never seen true buffalo-grass in Montana. It has been reported from several localities, but I have not seen specimens. The grama-grass equals the "blue-joints" in nutritive qualities, and doubtless covers as many acres, if not more, in this Territory, rarely growing tall enough to be cut for hay. It occurs sparingly in the foot-hills, but on the open plains holds its own; often 18 inches high, where growing luxuriantly. Leaves mostly at the base, very numerous, short and crisp, inclined to be curly. Average height of the plant (culms) as it grows on the range is about 8 inches. The plants usually grow thickly together in cushion-like patches, and so form a more or less dense turf according to the nature of the soil. In many parts stock subsist almost the entire year, mainly on this species. They readily fatten upon it, even in winter. If pastured too closely for several years by sheep it loses its vitality and becomes very sparse. Improves wonderfully in size when growing accidentally in cultivated ground. The whole plant becomes stronger and more robust; the culms seems to be more leafy and at-

tain a height of fully 18 inches. It seems to me that if properly cultivated this grass might become valuable for hay, and it certainly would make excellent pasture. Although most abundant on the benches, it grows well in fairly moist valleys, but too much wet injures it.

Phragmites communis, Trin. (Reed).—Common along streams and in marshy ground throughout. Of no apparent value as food and usually considered useless. In England and on the Continent in some parts, the stems are much used for thatching the roofs of farm-houses, barns, out-buildings, and stacks. It is highly esteemed for this purpose, making a durable, water-proof roof. I have seen roofs of reeds over a hundred years old in good repair; of course spots on these roofs had been rethatched occasionally. Reeds might be used here for similar purposes, particularly in regions where lumber is dear and shingles a luxury.

Kœleria cristata, Pers. ("June Grass").—Like the grama and "blue-joint" grasses, this is an important species on the ranges of Montana. It appears to be most abundant in the central, northern, and eastern parts. It is not confined to the plains, but may be found frequently on high mountain ridges in company with *Poa Californica*, *P. Cusickii*, and *P. andina*, where it frequently attains a growth of 2 feet high; whereas, on the plains, excepting in moist situations, it only averages about a foot in height. It begins to flower towards the end of May, and continues till about the end of June. Grows in tufts, and in vigorous mountain specimens these tufts are developed into small bunches. An excellent grass in every respect for open pasture and for hay.

Eatonia obtusata, Gray, var. *robusta*, Vasey. (Eaton's Grass).—A good grass, occurring most abundantly in the southern parts. Rather common along the water-courses of Beaver Head and Madison Counties. Have never found it in the northern part. Very fine specimens in my herbarium were collected by Rev. F. D. Kelsey at Blue Cloud, near Helena.

Eragrostis major, Host.—Is an introduced weed chiefly remarkable for the very offensive odor it emits, and even leaves upon one's hands after handling it. Not yet common.

Melica spectabile, Scribner (Melic Grass).—This is common in the mountains, but can scarcely be considered of pastoral value.

Melica bulbosa, Geyer (Bulbous Melic Grass).—Common in various parts of northern Montana, and doubtless occurs throughout. Never found it in the mountains. It grows plentifully in Sand Coulee, 5 miles from Great Falls. Might become a useful hay grass by cultivation. Culms 2 to 4 feet high, eaten with avidity by stock. The bulbous roots contain a considerable quantity of sugar.

Distichlis maritima, Raf. (Spike-Grass, Salt-Grass, "Quack-Grass").—Common, especially in alkaline soils. Grows from 3 inches to about 2 feet high. Leaves very prevalently attacked by a rust. Stock seem to avoid this *weed*, and ranchmen hate it.

Poa tenuifolia, Nutt. (Meadow-Grass, "Bunch-Grass," "Red-top").—A finer grass for cultivation on dry plains or in regions subject to drought can not be found. Grows in all parts of the Territory, chiefly on the high benches. But it also grows in the rich valleys, where it attains a good height and yields a great quantity of superior hay. Commonly associated with *Kœleria cristata*. As growing, the radical tufts of the two species have a very similar appearance.

Poa lævis, Vasey.—Reaches a height upwards of 2 feet. Found

chiefly along streams and in springy localities. It affords a valuable addition to the pastoral grasses of well-watered regions.

Poa nemoralis, L.—This grass has no particular habitat. It is frequently associated with *P. lævis*. Also abundant in the mountains. In 1887 I collected very fine specimens at the summit of Mount Helena, where cattle and horses belonging to the city below were grazing upon this and other grasses already spoken of.

Poa cenisia, All.—Is another valuable species abundant in the mountains and foot-hills.

Poa Cusickii, Vasey, *P. andina*, Nutt., and *P. Californica*, Vasey, are commonly found together. They are often accompanied by *Kœleria cristata* and *Festuca ovina*. These species growing together form a dense turf in some localities in the foot-hills and on the mountain slopes and ridges. The amount of pasturage they afford is very great.

Glyceria arundinacea, Kth., var. *aquatica*, Smith (Reed Meadow Grass, "Water-Grass").—Very common throughout in low, wet places; often growing in water. Leafy and tall, 3 to 5 feet high. Cows delight to feed in a patch of this grass.

Glyceria pauciflora, Presl.—Occurs in many localities, but, so far as I have observed, chiefly from the vicinity of Helena southward and westward. This is also an excellent grass.

Glyceria nervata, Trin.—Is to be found everywhere in situations moist enough for its growth. In some localities it contributes largely to the native forage.

Glyceria distans, Wahl.—Common. It is readily eaten by stock. The variety *airoides*, Vasey, is a common form along the Sun River Valley, and in Cascade County generally.

Festuca scabrella, Torr. (Great Bunch-Grass).—On the higher foot-hills and mountain slopes this is the predominant species. Growing in bunches often several feet in diameter, the culms rise to a height of 3, 4, and even 5 feet. In July and August this grass is cut for hay. Although it is good for this purpose, it is considered not nearly so good as "blue-joint." It is one of our most important and characteristic mountain and foot-hills forage plants.

Festuca ovina, L. (Sheep's Fescue, Lesser Bunch-Grass).—This grows with the last on the foot-hills, but extends to a much lower altitude. Very variable. May be found from a few inches with only one or two culms, up to more than 3 feet high with very many slender culms and leaves, forming dense, thick bunches. This species is the equal if not the superior of the great bunch-grass, and has the advantage of being equally as palatable to sheep as it is to horses and cattle. Makes splendid hay.

Bromus Kalmii, Gray, *B. breviaristatus*, Thurb., and *B. ciliatus* are all common; the first two in the mountains, where they sometimes form large meadows. They are then a beautiful, luxuriant sight; but stock do not seem to care for any of these grasses. I never saw them cut for hay.

Agropyrum glaucum, R. and S. ("Blue-joint," "Blue-stem").—This is the celebrated "blue-joint" of the Northwest. More valued for hay than any other species, and its yield per acre under favorable conditions is something remarkable, viz, over 3 tons. It often yields 2 tons, and under the most ordinary conditions yields over a ton. These crops are secured on native, uncultivated sod.

Agropyrum divergens is perhaps the next in general value. It grows in bunches, and for that reason has received the customary popular name of "bunch-grass." Sometimes attains a height of

nearly 4 feet. Most luxuriant in the lower foot-hills, but is common on the rocky bluffs and knolls of the plains, frequently occurring with *Aristida purpurea*. The culms, though slender, are very stiff and brittle. Stock avoid this grass in summer, but in winter in certain localities it is their chief support; hence it is considered an excellent species for winter ranges. Even sheep eat it then.

Other species more or less abundant are *A. caninum*, Reich., *A. violaceum*, *A. repens*, Beauv., and *A. tenerum*, Vasey. The last is of considerable importance in some parts.

Hordeum jubatum, L. (Foxtail Grass, Squirrel-tail Grass).—Throughout, mostly growing in waste places. Very variable; some of its forms are hardly distinguishable from *H. nodosum*. Regarded as a good-for-nothing weed. Often grows in patches of 5 to 10 acres large.

Elymus condensatus, Presl. (Lyme-Grass, Wild-Rye, Rye-Grass).—By the last name it is chiefly known here. It is of no great value, but abundant throughout along streams, in bottoms, and up steep coulée sides. Four to 8 feet or more high. The coarse stems, like those of *Phragmites communis*, would make a good thatch. Occasionally cut for hay. Must be cut young or stock will hardly eat it. Fed too long at a time to horses it causes them to "scour."

Several other species occur, but they are of even less value than this. *E. sitanion*, Schult., in some of the southern localities is almost as great a nuisance as *Hordeum jubatum*.

CONCLUDING REMARKS.

It will be seen from the foregoing notes that Montana is blessed with a great variety of nutritious grasses adapted to all kinds and conditions of soil. On the plains *Poa tenuifolia*, *Kœleria cristata*, *Stipa comata*, *Bouteloua oligostachya*, *Agropyrum glaucum*, and *Agropyrum divergens* are the leading species. Every one of them fills an important niche in pastoral vegetation. In the foot-hills *Festuca ovina*, *Poa tenuifolia*, *Agropyrum divergens*, and *Agropyrum tenerum* take the lead. On the higher foot-hills and mountain slopes *Festuca scabrella*, *Agropyrum caninum*, and *Poa tenuifolia* are the chief. Still higher are the *Poas*, of several species predominating. Along water-courses and in wet places the leading species are *Phalaris arundinacea*, *Deyeuxia neglecta*, *Deyeuxia Canadensis*, *Agrostis exarata*, *Glyceria arundinacea*, var. *aquatica*, and *Poa lævis*.

Grasses are not the only forage plants in Montana. Such species of Carex as *C. filifolia*, *C. stenophylla*, and *C. Douglasii*, form an important part of the diet of stock on the benches; while *C. filiformis*, *C. utriculata*, *C marcida*, and several other species are as important in the moist valleys and sloughs.

It has been estimated roughly that in northern and eastern Montana from 3 to 5 acres of grass land is sufficient for a horse or steer for one year, and that about 1 acre is sufficient for a sheep. In the south and southwestern parts from two to four times this amount is necessary. But any of these figures, if correct, speak volumes for the pastoral resources of this Territory.

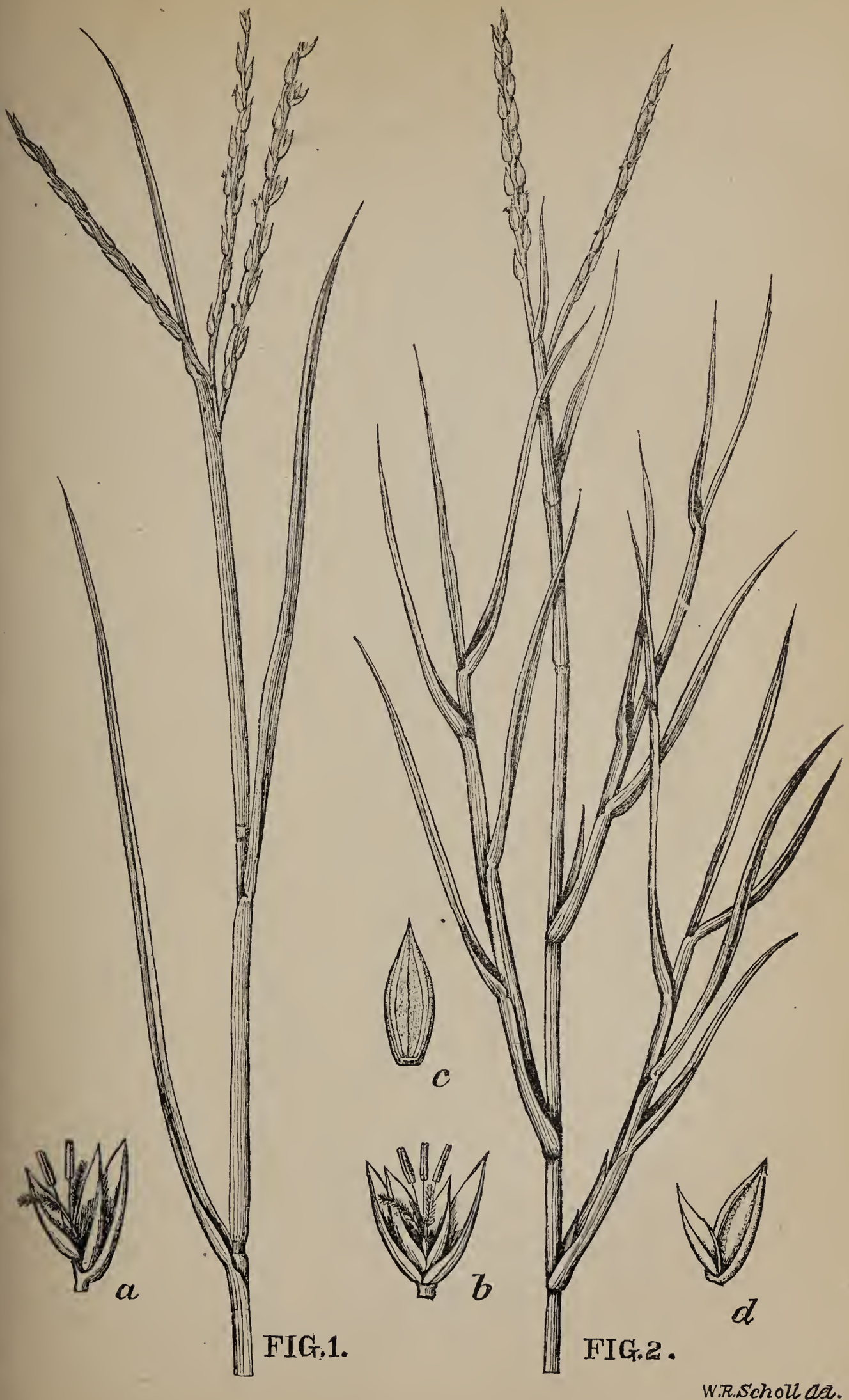
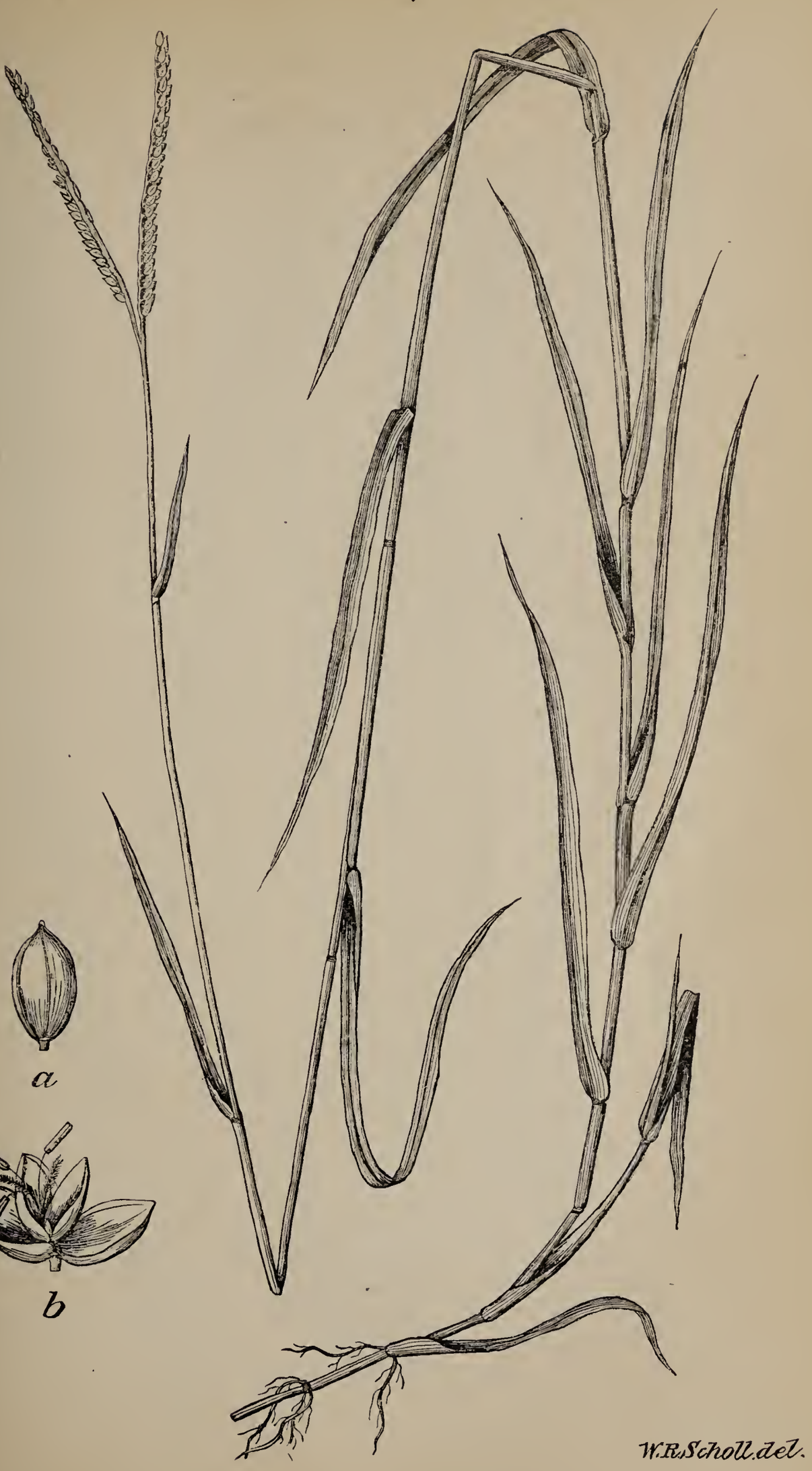
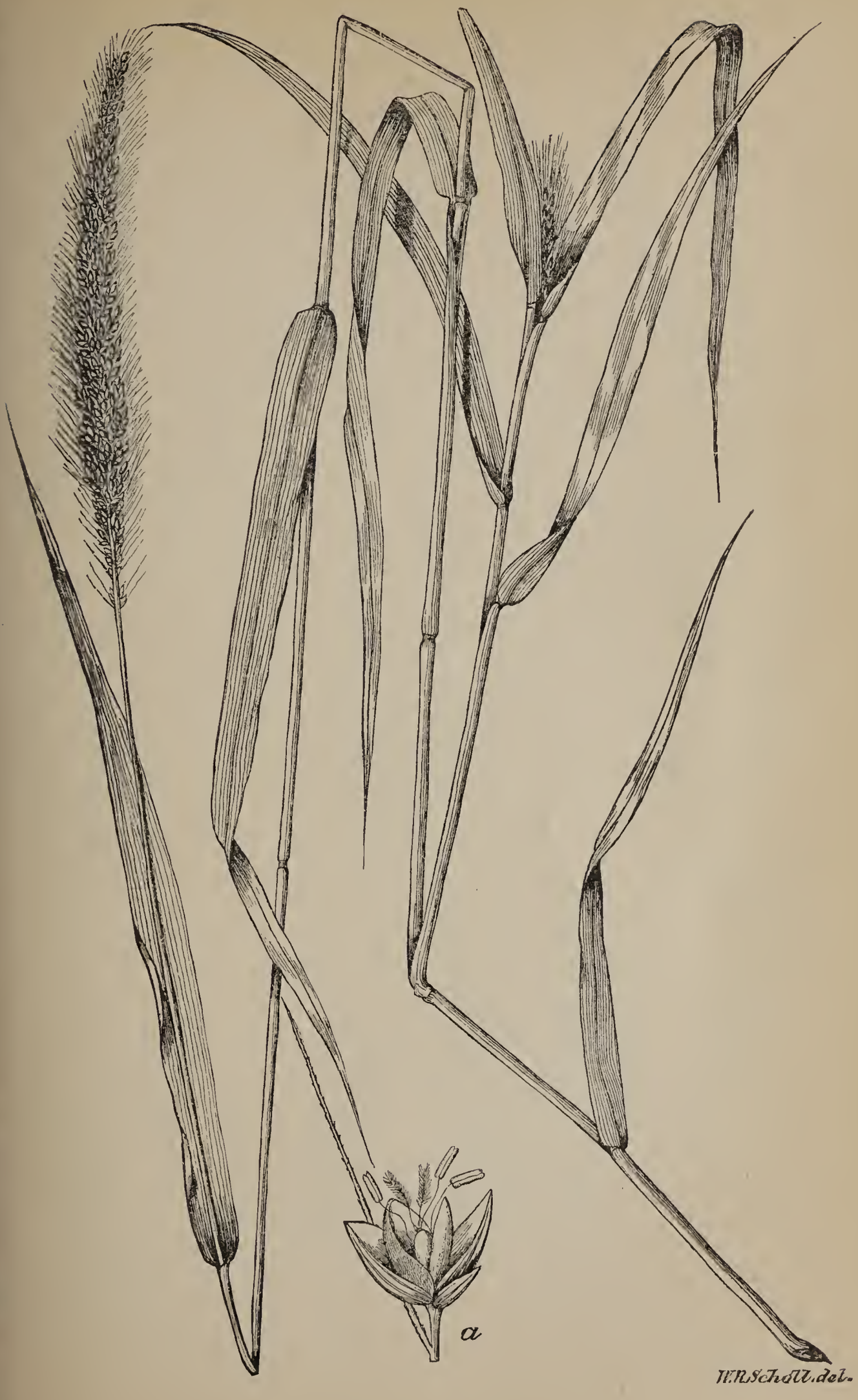


FIG. 1. REIMARIA OLIGOSTACHYA.

FIG. 2. PASPALUM VAGINATUM.

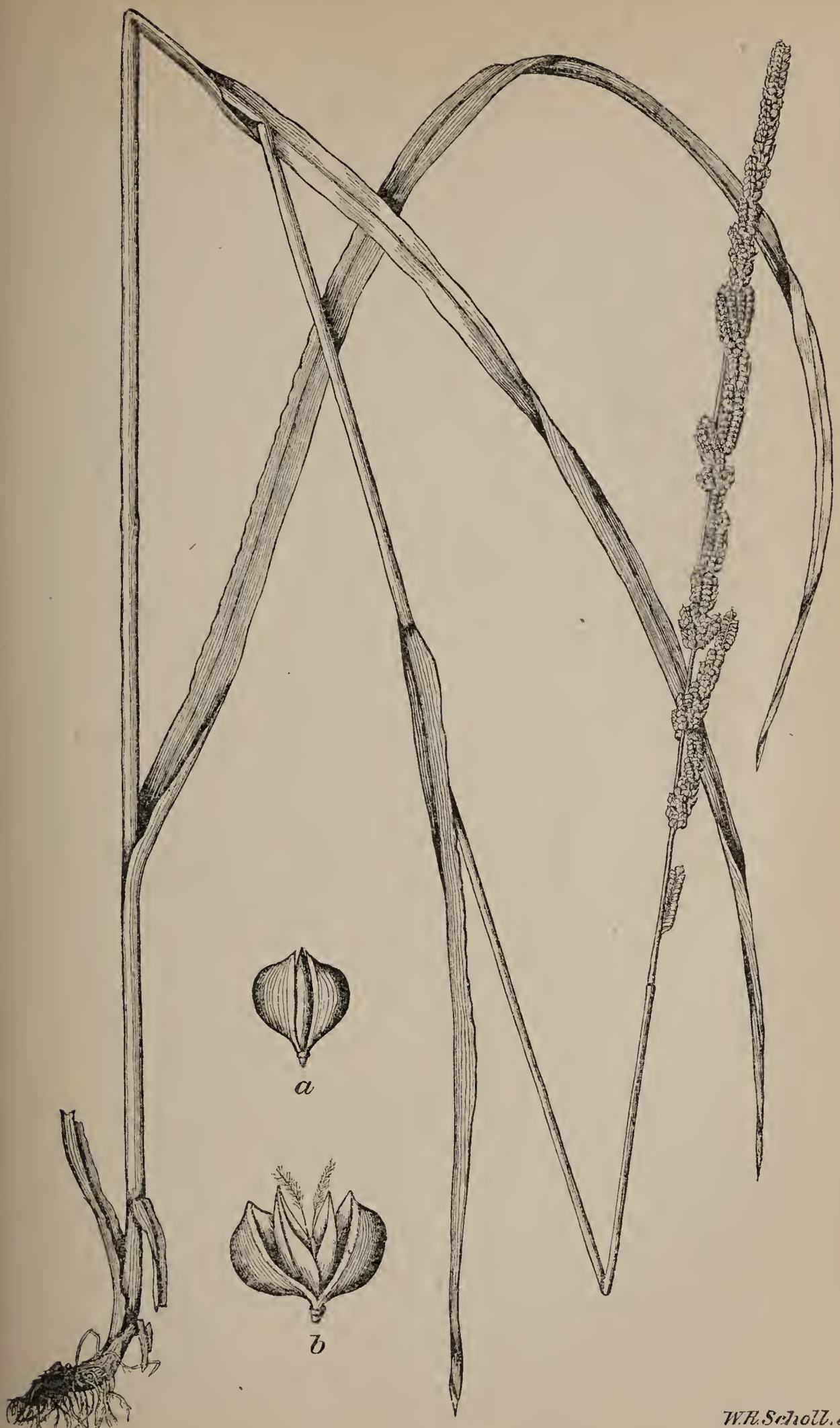


PASPALUM DISTICHUM.



SETARIA VIRIDIS (GREEN FOXTAIL).

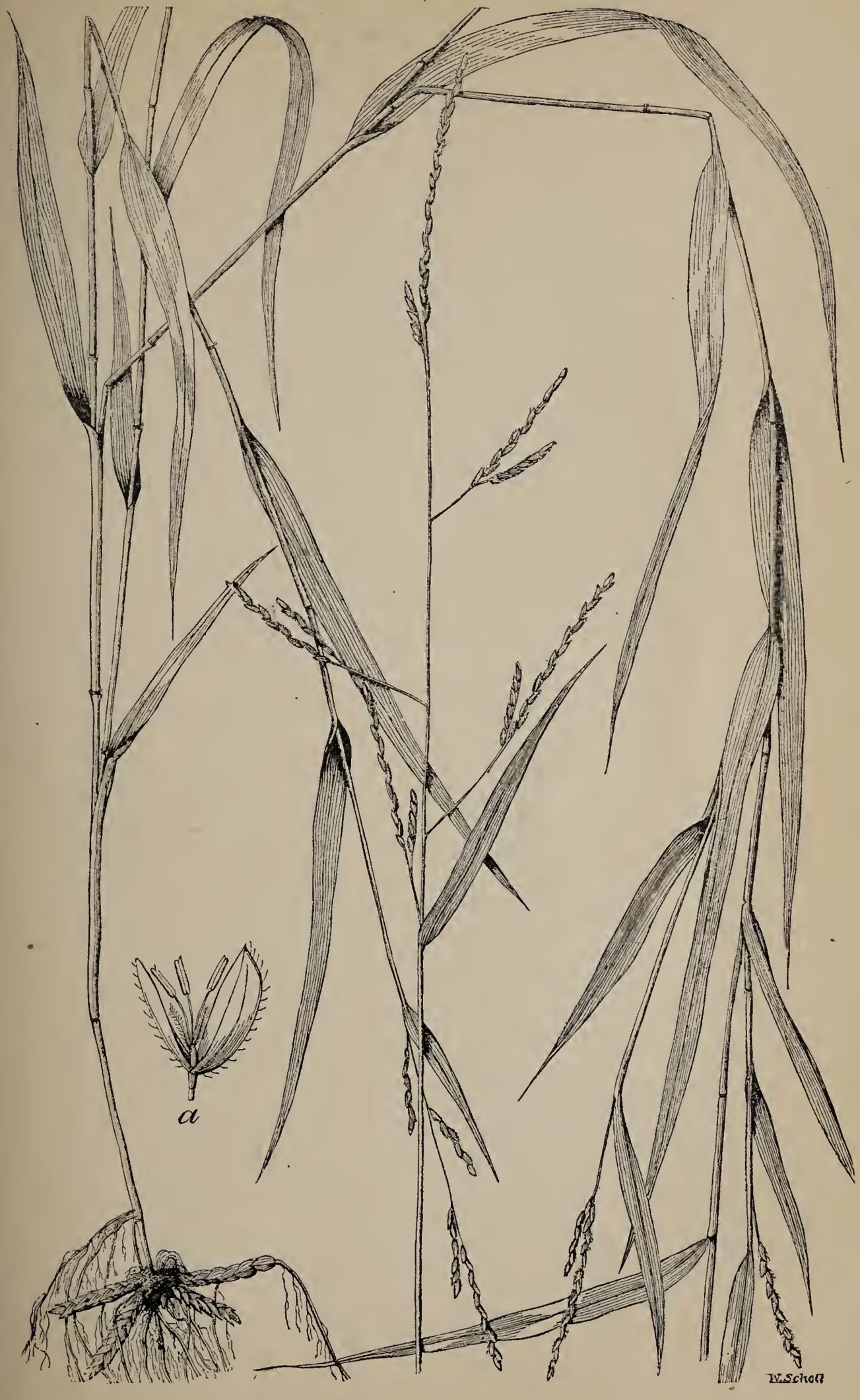
OPLISMENUS SETARIUS.



BECKMANNIA ERUCÆFORMIS (SLOUGH GRASS).

ANTHENANTIA RUFA.

AMPHICARPUM PURSHII.



LEERSIA VIRGINICA (RICE-GRASS).

POA ANDINA.

AGROPYRUM GLAUCUM (COLORADO BLUE STEM).

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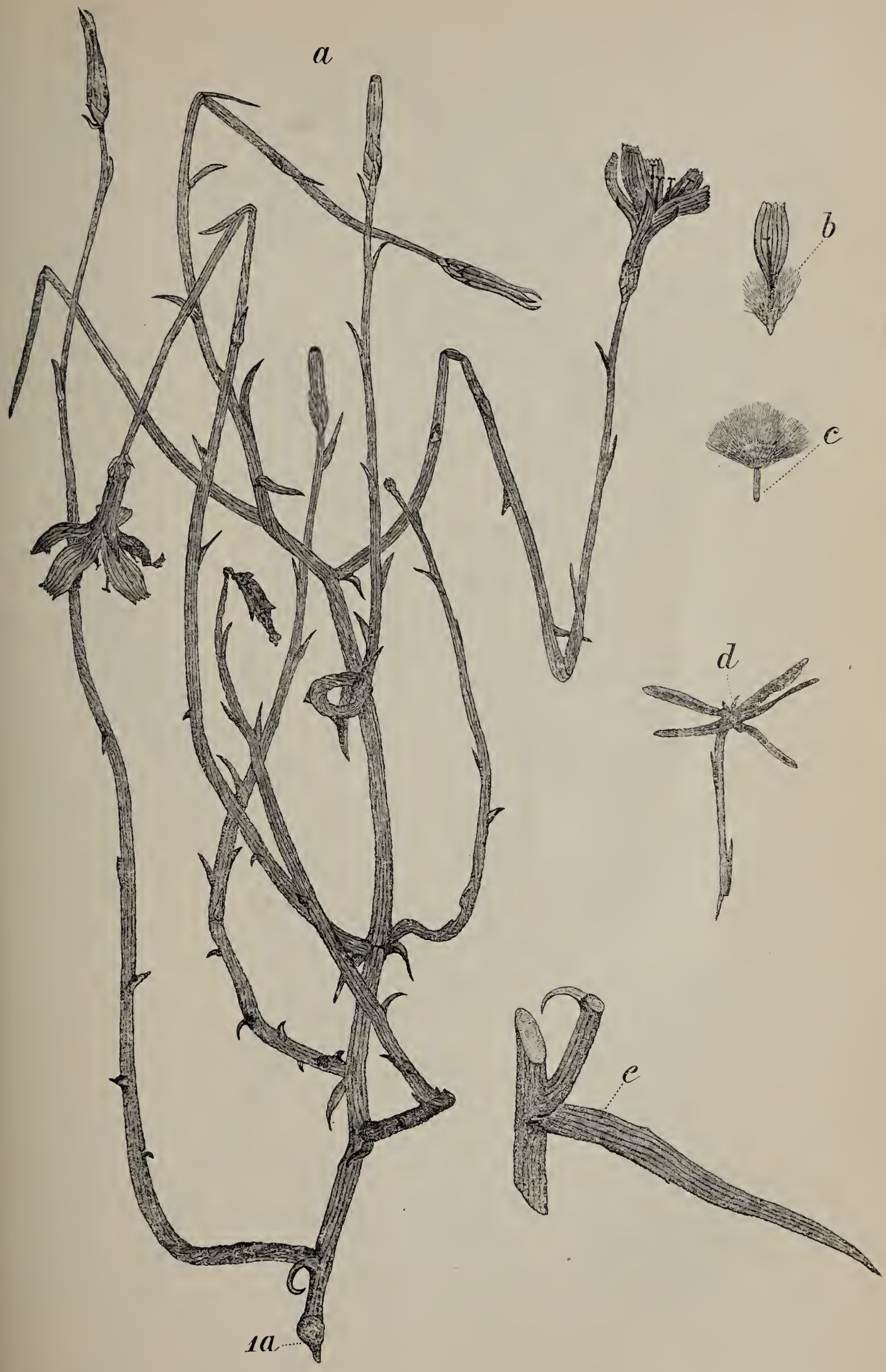
PLANTAGO PATAGONICA, JACQ. (WESTERN PLANTAIN).

Figs. 1 to 6 greatly enlarged.



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LYGODISMIA JUNCEA.

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SOLANUM TRIFLORUM (WILD POTATO).